



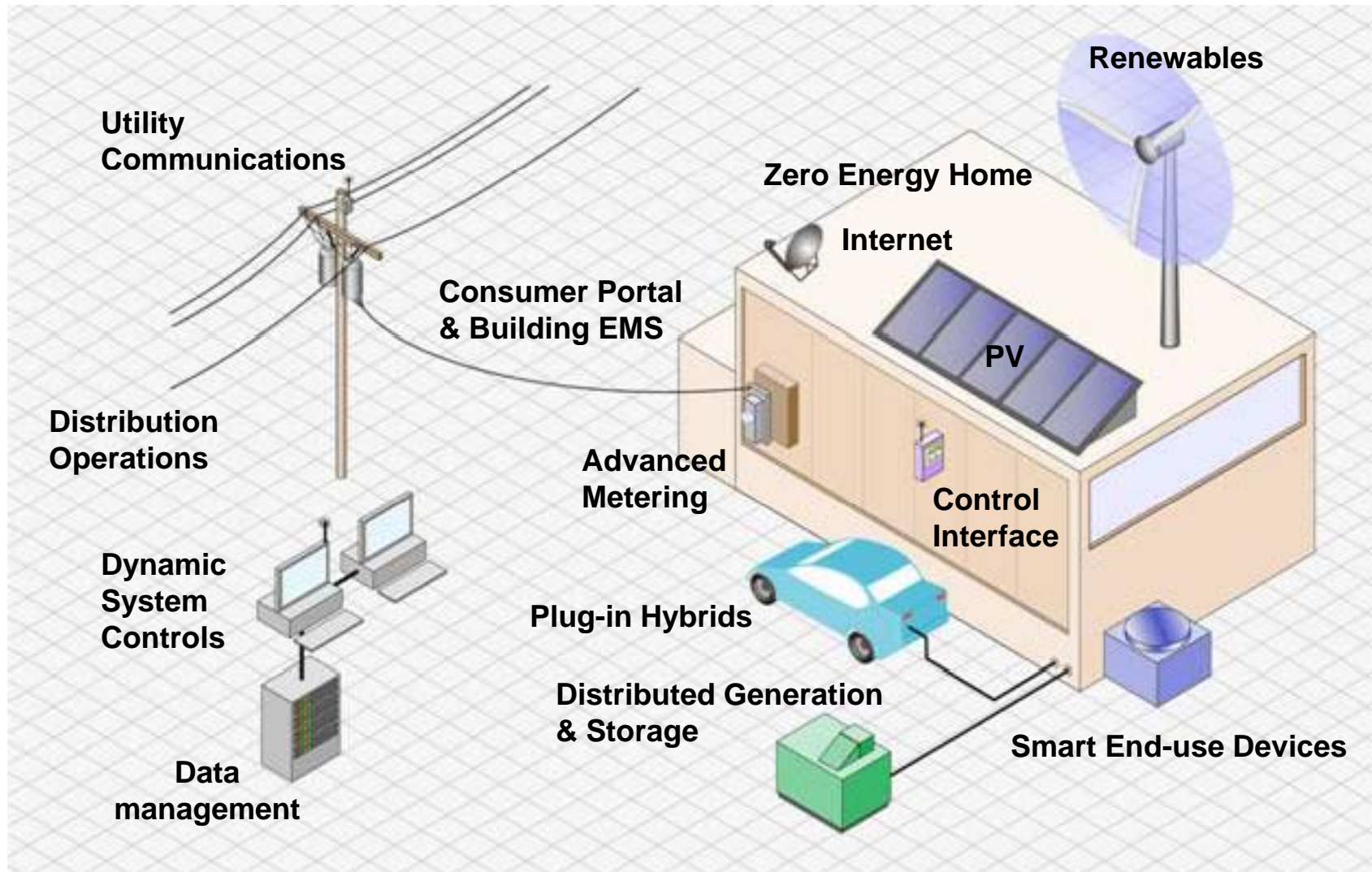
SMUD and the Smart Grid

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**CEC Load Management Standards
Smart Grid Workshop**

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Smart Grid Vision



EPRI Intelligrid



SMUD Smart Grid Elements

- **Distribution System Smartening**
 - Add or Expand SCADA at our distribution substations
- **AMI**
 - Intercommunications with SCADA
 - Communications with end uses
- **Demand Response**
 - System and targeted load control
 - Price response
- **Distributed Generation**
 - PV
 - CHP
 - Plug-In Hybrids
 - Storage
- **Zero Energy Smart Homes**
 - Combines all of the above

Distribution System Smartening

- **In process of integrating existing substations into SCADA**
 - Updating relaying (integrated electronic devices) and metering
 - Adding remote control
 - ~One-third of existing substations rewired to date
 - All new substations for last 10 years installed with SCADA
- **Automating with remote control some critical 69kV switches**
- **Capacitor control algorithm on substation and pole capacitors that dispatches capacitors for local and system needs**
- **AMI RFP requirement that communication system be able to support smart SCADA**

Potential Network Improvements

- **Focus on distribution level improvements**
 - SMUD has own transmission control area
- **Ultimate goal is to automate to the circuit level**
 - Integrate end point voltages into SCADA to manage voltage profiles better
 - Automatic sectionalizing and load restoration
 - Deploy CVR (conservation voltage reduction) to systematically run tighter margin on voltages and loading
 - Dynamic circuit configurations to reduce losses
- **Overlay AMI for outage notification, load management, meter and meter data management, theft detection, billing services, etc.**

Distribution Efficiency

- **Current distribution losses = 9%**
- **Specified high efficiency transformers**
- **Close monitoring of distribution system helps identify power theft**
- **Contract with NREL to determine the benefits of wide-deployment PV**
- **Look at possibility to downsize distribution equipment based on results**

Automated Metering Infrastructure

- **AMI RFP is on street, due middle of June 2008**
- **AMI Requirements:**
 - Two-way communications
 - Communications protocol agnostic
 - Robust, secure, and scalable
 - Interval data and TOU capabilities
 - Home Area Network agnostic
 - Enables programmable communicating thermostat control and in home displays
 - Enables end-to-end system efficiencies—from generator to end use
- **AMI full deployment scheduled for 2009 - 2012**

Planned Demand Response

- **Develop load control programs to manage system peak load and target distribution system anomalies**
 - Replace existing residential ACLM controllers with PCTs
 - Offer PCT-based temperature reset programs to residential and small commercial customers
 - Offer aggregator load control program to medium and large commercial customers
 - Expand auto-DR capability
- **Develop time-dependent rates**
 - Offer TOU and CPP rates to all classes
- **Use AMI to:**
 - Measure and predict load control and price response
 - Identify distribution problems and manage local load and voltage

Distributed Generation

- **CHP/District Energy**

- Key drivers are GHG reductions, customer savings and peak load reduction
- Identified 375 MW potential, 750 MW with cooling and heating
- Conducting feasibility studies with candidate customers
- Moving forward in negotiating cost effective projects
- In parallel, developing CHP Program

- **Plug-In Hybrids**

- Investigating active charge control and energy metering
- Potential vehicle-to-grid, vehicle-to-home

- **Storage**

- Battery storage
 - A 20kW - 9hr vanadium redox flow battery installation at a Sacramento Sprint-Nextel site to be installed in September 2008
 - ZEH battery storage
- Thermal storage
- Ultracapacitors – Light rail 1MW in 20 seconds

- **PV**

- 4,000+ SolarSmart (solar/>30% Title 24) homes in pipeline

SMUD SolarSmart Homes

- **Long term goal : Homes that produce as much energy as they use on an annual basis (annual net-zero energy use) by 2020**
- **CRADA with NREL/DOE Building America Program**
 - Current program = 60% reduction in energy bill
 - Target annual net-zero electricity use
 - Use commercially available technologies
- **Zero Energy Home Pilots**
 - Developed cost effective prescriptive package of EE and PV
- **SMUD SolarSmart Homes**
 - Applied ZEH pilot experience (EE/PV package)
 - 2007 roll out of standard utility program
 - Market transformation underway – 30%+ market penetration

SMUD ECOSMART Home

- **Next generation homes**
 - Build true Zero Energy Home—a home with no annual electric or natural gas utility bill, and *zero net electric demand during summer peak periods*
 - **Continue R&D with NREL**
 - **Current Energy performance goals**
 - Annual source energy: 80% reduction
 - Zero net summer peak electric demand: 4 PM to 8 PM
- **Develop new package of advanced (not yet commercialized) EE and DR measures, solar PV and solar thermal**
 - Super tight envelope - advanced framing, SIPS
 - Evaporative condensers
 - Home automation
 - Pre-cooling
 - Price signaling
 - In home display (production and consumption)